ENERGY CHANGE

Chapter 5 (Section 5.2)

Thermochemical Equations

OUTLINE

- Thermochemical Equations
- Enthalpy Diagrams
- Molar Enthalpy of Combustion
- Example Questions

THERMOCHEMICAL EQUATIONS

- Thermochemical Equation- A balanced chemical equation accompanied by the value of ΔH^o that corresponds to the mole quantities specified by the coefficients.

- For example:

$N_{2(g)} + 3H_2 \rightarrow 2NH_{3(g)}$ $\Delta H^o = -92.38kJ$

$2N_{2(g)} + 6H_2 \rightarrow 4NH_{3(g)}$ $\Delta H^o = -184.8kJ$

$\frac{1}{2} N_{2(g)} + 3/2H_2 \rightarrow NH_{3(g)}$ $\Delta H^o = -46.19kJ$

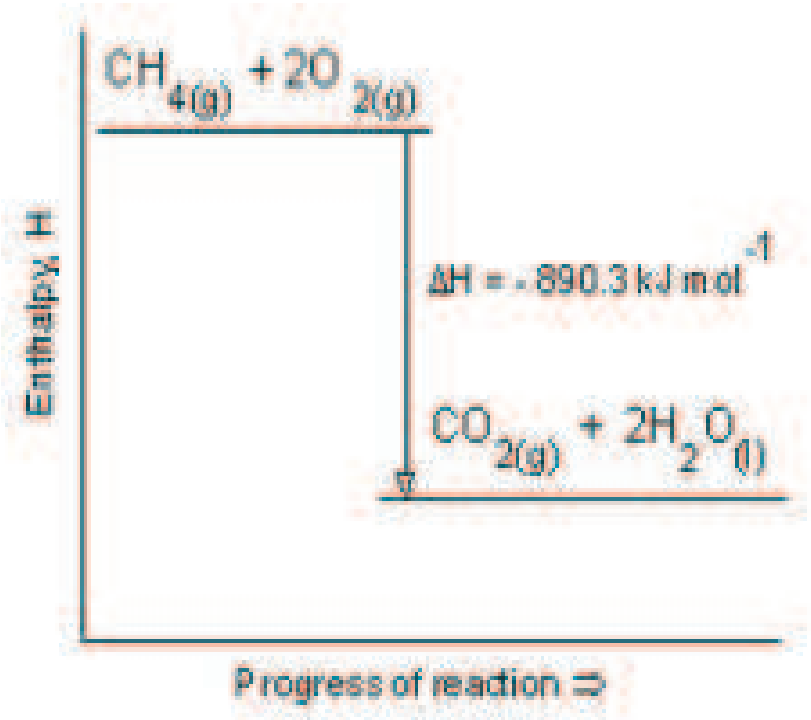
OR

$N_{2(g)} + 3H_2 \rightarrow 2NH_{3(g)} + 92.38kJ$

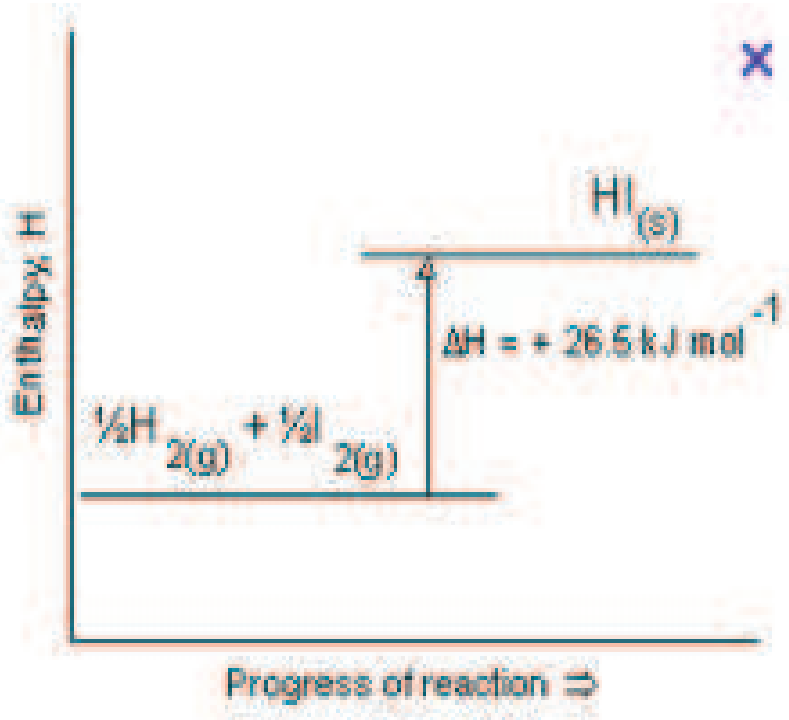
$2N_{2(g)} + 6H_2 \rightarrow 4NH_{3(g)} + 184.8kJ$

$\frac{1}{2} N_{2(g)} + 3/2H_2 \rightarrow NH_{3(g)} + 46.19kJ$

ENTHALPY DIAGRAMS



Combustion of methane (CH_4)



Production of hydrogen iodide (HI)

Video: Enthalpy diagram for combustion of methane (specific to molar enthalpy)

MOLAR ENTHALPY OF COMBUSTION

- Molar Enthalpy- is the transfer of heat in a reaction per mole (mol).

- Recall: Finding moles from grams

1) Find the mass of the reactant you are interested in.
2) Find the molar mass of the reactant.
3) Convert mass into moles.

Manipulate this equation to your needs:

$\Delta H_r = n \Delta H^o_r$ ΔH^o_r is molar enthalpy at SATP

If you are looking for the molar enthalpy rearrange the equation to get: $\Delta H^o_r = \Delta H_r / n$

EXAMPLE 1

- When 1 mol of CH_4 is burned at constant P, 890 kJ of heat is released. Find ΔH for burning of 5.8 g of CH_4 at constant P, 890 kJ is released per mole of CH_4.

EXAMPLE 2

- When methane is combusted, along with the heat produced, oxygen is consumed. Determine the mass of oxygen consumed if the total change in enthalpy of the reaction is -2.5×10^2kJ, given the equation:

$$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$$

EXAMPLE 3

- What is the enthalpy change when 4.608g of ethanol, $C_2H_5OH_{(l)}$, undergoes complete combustion? Overall enthalpy of reaction is -13668kJ.

HOMEWORK

- Readings page 292-299
- Page 299 #11, 14, 15, 19